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50. **Proposed by GEORGE LILLEY, Ph. D., LL. D., Principal of Park School, 329 East Second Street, N. Portland, Oregon.**

A draw bridge, a feet in length, moves uniformly about a center axis. At the instant it began to open, a man stepped on the end; and, walking at a uniform rate in the straight line passing through its center, reached the opposite end just as it made n complete revolutions. Find the absolute path described by the man, and the ratio of his rate of motion in this path and the velocity of the end of the bridge. Apply the result to the case when $a=320$ and $n=2$.

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MECHANICS.

Conducted by B. F. FINKEL, Springfield, Mo. All contributions to this department should be sent to him.

SOLUTIONS OF PROBLEMS.

30. **Proposed by WILLIAM HOOVER, A. M., Ph. D., Professor of Mathematics and Astronomy, Ohio University, Athens, Ohio.**

P is the lowest point on the rough circumference of a circle in a verticle plane at which a particle can rest, friction being equal to the pressure; to find the inclination of the radius through P to the horizon.

Solution by the PROPOSER.

If μ=the coefficient of friction, R=the normal reaction of the curve, μR= the friction, $=R$ by the problem. $\therefore \mu=1$.

W being the weight of the particle, we have, resolving along the tangent and radius through P,

$$W\sin\phi=\mu R\ldots\ldots(1).$$

$$W\cos\phi=R\ldots\ldots(2).$$

These give $\tan\phi=\mu=1$, or $\phi=\dfrac{\pi}{4}$.

Excellent solutions of this problem were received from *PROFESSORS ALFRED HUME*, *O. W. ANTHONY*, and *E. L. SHERWOOD*.

31. **Proposed by O. W. ANTHONY, M. Sc., Professor of Mathematics in New Windsor College, New Windsor, Maryland.**

A perfectly elastic, but perfectly rough mass M and radius R, rotating in a verticle plane with an angular velocity of ω, is let fall from a height, a, upon a perfectly elastic, but perfectly rough horizontal plane. Determine the motion of the body after striking the plane. What will be its ultimate motion?

Solution by ALFRED HUME, C. E., D. Sc., Professor of Mathematics in the University of Mississippi, University P. O., Mississippi.

Let the angular velocity, ω, be in the direction of the motion of the hands of a clock.

Let ω' and v' be, respectively, the angular velocity, and the horizontal velocity of the center of the sphere, after the first impact.

The impulsive action at the point of contact is, then, Mv'.

The change in the angular momentum being equal to the moment of the impulse,

$$\tfrac{2}{5}MR^2(\omega-\omega')=Mv'R.$$

The surfaces being perfectly rough, there is no slipping and

$$v'=R\omega'$$

$$\therefore\ \tfrac{2}{5}(\omega-\omega')=\omega',$$

$$\omega'=\tfrac{2}{7}\omega\,;$$

$$v'=\tfrac{2}{7}R\omega.$$

v'' and ω'' representing horizontal and angular velocities after second impact,

$$M(v''-v')=\text{impulsive friction},$$

$$\tfrac{2}{5}MR^2(\omega''-\omega')=-M(v''-v')R,$$

$$\tfrac{2}{5}(\omega''-\omega')=\omega'-\omega'',$$

$$\omega''=\omega'=\tfrac{2}{7}R\omega.,\text{ and } v''=R\omega''=\tfrac{2}{7}R\omega.$$

The sphere moves on in an endless series of equal parabolas, with constant angular velocity and constant horizontal velocity, reaching the height a after every rebound.

Solutions of this problem were also received from Professors Zerr and Anthony. One or both of these solutions will appear in the next issue of the MONTHLY.

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DIOPHANTINE ANALYSIS.

Conducted by J. M. COLAW, Monterey, Va. All contributions to this department should be sent to him.

SOLUTIONS OF PROBLEMS.

30. Proposed by COOPER D. SCHMITT, M. A., Professor of Mathematics, University of Tennessee, Knoxville, Tennessee.

A and B are two integers, A consisting of $2m$ figures each being 1, and B consisting of m figures each being 4. Prove that $A+B+1$ is a square.

I. Solution by H. W. DRAUGHON, Olio, Mississippi, and O. W. ANTHONY, M. Sc., Professor of Mathematics in New Windsor College, New Windsor, Maryland.

Each of the integers is a Geometrical Series.